Does trace metal dynamics in moss controls biological N_2 fixation in boreal forest?

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Biological Nitrogen Fixation (BNF) by moss associated cyanobacteria (MAC) is the main source of new nitrogen in boreal forest. BNF is regulated by nitrogen, phosphorus and trace metals availability, but its response to this nutrients additions is highly variable, likely reflecting high spatiotemporal variability in their availability to MAC.

We hypothetised that nutrient limitation (i.e, P and metals) of BNF is affected by atmospheric deposition with less acute limitation in moss close to human centers as compared to moss in remote area. We also hypothetised that nutrient contents in mosses are affected by moss growth and precipitation regime, thus resulting in important variation in nutrient limitation of BNF over the course of the growing season. To test that, moss samples were collected at the begining and the end of the growing season on seven sites along a 600 km latitudinal gradient of atmospheric depositions in Quebec. A monthly sampling was performed on one remote site from May to September. P and metals contents were analysed by ICP-MS and BNF by acetylene reduction assay.

We report that (i) moss is trace metal poor and P rich as compared to other compartments of the soil, (ii) atmospheric deposition is a major source of metal to moss even in remote areas. More importantly, results show that total nutrient concentratrion alone failed to predict limitations of BNF by MAC. Future research on nutrient bioavailability to MAC, as opposed to total concentration in moss, is required to better predict nutrient limitation of BNF by MAC.